

## Department of the Interior

### Museum Property Handbook I

#### Chapter 9: Museum Property Storage

##### A. Overview

1. What is museum property storage?

Museum property storage is a crucial function in the proper care and effective management of the Department's museum property collections. Approximately 93% of the Department's museum property holdings of historical objects, art objects, ethnographical objects, archeology materials, natural history specimens, and archival items are being stored. Management and care of stored museum property have a major impact on preservation, protection, and use of this resource.

Museum property storage is a function that includes both space and a process.

- It is space that you dedicate to storing collections. It is space designed or upgraded to maximize the protection and preservation of the collection and provide for its optimum use.
- It is a process of ongoing thought and continuing care for the museum property while it is in being stored. Each decision you make about storage should consider how changes would improve the protection, preservation, and use of the museum property.

When you place an object on exhibit you usually compromise about the conditions that are best for preservation. Exhibited objects are exposed to a more severe environment and are more susceptible to theft and vandalism. However, it is a different matter with museum property collections when they are properly stored. In storage, you have more control over conditions affecting the objects. You can achieve close to ideal preservation conditions by following good collection storage methods.

2. What is a preventative conservation program?

A preventive conservation program avoids, mitigates, or minimizes the deteriorating effects of the environment, protects against fire and poor handling, and provides physical security to the museum collection.

3. How does museum property storage fit into a preventative conservation program?

Good museum property storage is a major component of a preventive conservation program to preserve your museum property collection. A well-planned and organized storage function reduces the risk to the property. Other chapters in this handbook discuss different aspects of your preventive conservation program. Deterioration, damage, or loss will be minimized if you have:

- proper storage techniques
- good handling practices (see Chapter 8)
- effective security and fire protection (see Chapters 11 and 12)
- appropriate environmental conditions (see Chapter 5)
- a pest free environment (see Chapter 6)

A well-planned and organized museum property storage space also ensures that museum objects are accessible.

4. What is a collection storage system?

Preserving museum objects in storage involves evaluating the total museum storage system housing the collection. A collection storage system is the protective envelope surrounding the collection. It includes three levels of containment:

- the space (facility)
- the equipment
- the containers

Although museum property storage situations vary from unit to unit, the factors that need to be considered to properly house a collection remain the same. Evaluate each level of the system and adapt it to meet your unit's specific collection preservation and protection needs. Be practical and evaluate the storage system in relation to your unit's available space and obtainable funding.

You should consider the cost, both in funds and staff time available, when making decisions regarding museum property storage.

The levels of containment in a collection storage system are illustrated in Figure 9.1 found at the end of this chapter.

## **B. Standards and Requirements for Collection Storage**

### **1. What are the museum property storage standards and requirements?**

Museum collections require special storage conditions. Standards and requirements for managing museum property are based on professional museum practices and Departmental policy.

The Interior Departmental Manual, Part 411, *Policies and Standards for Managing Museum Collections*, Chapter 3 provides departmental standards for museum property storage.

The "DOI Checklist for Preservation, Protection, and Documentation of Museum Property" provides general guidance for collection preservation and protection. See Appendix E in this Handbook.

The National Park Service Conserve O Gram (COG) series is referenced throughout this chapter as these documents reflect standards and methods used by the Department of the Interior as a whole. COGs can be accessed at the website <http://www.cr.nps.gov/museum/publications/conservoogram/conserv.html>.

DOI collection storage standards can be summarized as follows:

Safe and secure storage of museum collections requires dedicated space. You must use museum storage areas only for museum collections. To the extent possible, separate museum storage from all other uses, including office space and research and work areas. Museum collections require suitable and sufficient space. The space you select for museum storage must be adequate to accommodate the particular characteristics and quantity of objects, specimens and archival items you have in your collection and provide adequate space to accommodate reasonable growth of the collection. Organize the space to allow for the efficient use of curatorial equipment and techniques and to provide for effective access and optimum preservation of the museum collection. House objects in appropriate containers and package objects with appropriate materials.

The following storage information elaborates or expands on the standards in 411DM, Chapter 3 and the guidance in Appendix E, "DOI Checklist for Preservation, Protection, and Documentation of Museum Property".

2. Where do I start in establishing my collection storage needs?

Complete the "DOI Checklist for Preservation, Protection, and Documentation of Museum Property" in Appendix E. This checklist helps you evaluate your collection storage needs in the following areas:

- facility and space requirements
- protection requirements (physical security and fire protection)
- environmental requirements
- museum equipment and container requirements
- housekeeping requirements

Complete the checklist by printing out Appendix E of this Handbook and answering the list of questions. If you use the Re:discovery or the NPS ANCS+ collection management computer software program, an automated checklist can be accessed and completed in the Utilities Module.

3. What are the collection storage facility and space requirements?

Facility and space requirements deal with adequate space, construction features and design loads for collection storage.

Make sure the collection has suitable and sufficient space for proper storage. Suitable space is planned space that has been evaluated for its adequacy for storing museum objects. Outbuildings, closets, unimproved basements, and attics generally are not suitable spaces. These inadequate spaces rarely contribute to the preservation and effective use of a collection.

4. How do I ensure that I have adequate space to store the collection?

The storage space must be large enough to accommodate the existing collection as well as the projected growth of the collection over the next 10-20 years. The amount of storage space you need is derived through a process of matching the

museum property in your collection to specialized equipment necessary to store the materials. Then determining the amount of space needed to contain the equipment. Refer to NPS *COG 4/11, "Determining Collection Storage Space Requirements"* to determine your space requirements.

Your space should:

- allow use of proper storage equipment and techniques
- integrate aisles at least 48" wide between rows of equipment. This width allows safe handling and movement of drawers, cabinet doors, and larger objects.

Make sure the space allows movement of personnel, equipment and objects in and out without hindrances such as inadequately sized doors; narrow, winding, or steep stairs; or passageways with low ceilings.

Carefully plan and organize your storage space to make the collection easy to access for study, exhibition, or accountability.

5. What general construction features contribute to storing the collection?

Collection storage facilities and spaces should be constructed to meet the following requirements:

- Make sure the storage space is not located on a 100 year floodplain. This is in accordance with Executive Order 11988, "Floodplain Management," May 24, 1977, (42 U.S.C. 4321).
- Use space that is constructed of fire-resistant or fireproof materials. Wood framed walls and ceilings should be constructed with gypsum wallboard to achieve a minimum one-hour fire rating (some codes may require a two-hour fire rating).
- Use space with as few windows and doors as practical to enhance security and environmental control, but not so few as to be in violation of health, safety and fire codes. See National Fire Protection Association *NFPA 101, Life Safety Codes 2003 Edition and OSHA Standard 1910.36, General requirements, Means of Egress*.

- Use space with as few exterior walls as practical. This will minimize the chance of condensation on walls and windows during seasonal and diurnal temperature changes, enhance security, and increase energy efficiency.
- Make sure the space is free of water and sewer pipes and valves that can burst or leak and cause damage. Note: Water lines associated with fire suppression systems are allowed. Spaces equipped with fire sprinkler systems should have adequate floor drain(s) with backflow check valve(s).
- Make sure space is free of electric junction boxes, gas and electric meters, and gas lines. This will limit the need for access by non-curatorial staff and minimize security concerns.
- Store only collections in the space. Local and national building codes usually rate collection storage space as a “storage occupancy.” Locate work, office, research and supply storage areas close to, but not within, the storage space.
- Insulate the space so it will maintain a stable environment that protects the objects from adverse temperature and relative humidity conditions and damage from biological infestations. Insulate walls to a minimum R-19 rating (usually a 6" thickness of spunglass bat insulation) and the ceiling to a minimum R-30 rating (usually a 9" thickness of spunglass bat insulation.) Install a vapor barrier in walls, ceilings and floors.
- Require woodframe walls to be a minimum of 6" thick, constructed with 6" metal or wood studs. This thickness of woodframe wall construction provides structural strength and is capable of accommodating the required insulation.
- Use metal hollow-core or wooden solid-core doors equipped with mortise or key-in-knob and deadbolt locks for all entrances into the storage space. Door hinges should be on the interior side of the door. If exterior hinges are used, spot weld hinge pins to prevent easy removal.
- Install rigid foam insulation and a vapor barrier in concrete floors on grade. Make sure the level of the top of the concrete slab is at least 6" above the grade level of the soil.
- Seal concrete floors with a vapor proof epoxy or urethane paint or cover with dust impervious commercial composition, quarry or ceramic tiles.

Use dust impervious commercial composition, quarry or ceramic tiles as a floor finish over plywood subfloor sheathing.

- Make sure all electrical systems and equipment are UL listed and installed in full compliance with local and national electrical codes. You will need outlets to power supplemental environmental conditioning equipment, to allow for any task lighting, and to allow for use of vacuum cleaners.
- Make sure the space is free of ambient light sources that can damage objects. Use non-quartz/halogen incandescent or UV filtered fluorescent lighting and do not exceed 200 lux or 20 footcandles. Turn lights off when the storage space is unoccupied.
- Paint walls and ceiling with paint containing titanium dioxide pigment. Paint with titanium dioxide will absorb ultraviolet radiation emitted by ambient or artificial lighting.

6. What design loads should my storage space or facility have?

Your storage facility or space should be designed, upgraded, or modified to achieve the following requirements and recommendations:

- Use space capable of sustaining a live floor load of 150 pounds per square foot. Floors constructed to a lesser load capacity may be considered if you install spot load supports (usually post supports from below) and arrange equipment to take advantage of existing structural supports (usually equipment arranged around the perimeter of a room close to load bearing walls). Consult a structural engineer to determine the suitability of a floor and the placement of supports and equipment. A live floor load of 200-250 pounds per square foot is recommended if you use a moveable aisle (compactor) storage system. Consult a structural engineer to determine the required load rating for a floor supporting collections of exceptional weight.
- Design and construct roofs of storage spaces or facilities to accommodate the snow load of the area.
- Design or retrofit structures in areas of seismic activity to minimize earthquake damage.

- Consider reinforced concrete or masonry construction with a wind load rating of 110 miles-per-hour or higher for new construction of stand-alone storage facilities in areas susceptible to severe wind conditions. Fasten roofs to the wall and/or foundation structural components so the roof can withstand hurricane force winds

7. Where do I find additional information on storage space requirements?

Refer to the bibliography at the end of this chapter and in the COG series for additional information and specific guidance for planning collection storage spaces.

8. Why should my collection storage space be used exclusively for storing collections?

Separate curatorial office, work and research spaces from the space housing your museum collection to minimize environmental impacts on the objects and security risks. Refrain from combining storage space with other functions for the following reasons:

- Collection security generally decreases and theft, mishandling, and vandalism increases with storage room visitation and use.
- People working in the storage area increase the number of air exchanges the area must undergo. Air exchanges cause temperature and relative humidity levels to fluctuate, resulting in the possible deterioration of objects.
- Work areas require lighting levels that may cause damage to unprotected light-sensitive objects.
- Movement of people into and within the area tracks in soil and disperses dust into the air, which in turn, is deposited on surfaces of equipment and objects.
- Threats to the collection from pests increase with the staff time spend in the collection storage room.
- Store flammable liquids and materials, curatorial supplies, audiovisual equipment, and other interpretive materials outside the museum storage space. These actions will reduce the risk of fire and lessen clutter within

the storage space.

9. Where should I locate the research space?

Locate research space convenient to, but not within, the collection storage space. Research is one of the fundamental uses of a museum collection and the space for the research function has specific requirements. Refer to NPS Conserve O Gram 4/14, *Planning a Research Space*.

10. Where should I locate work and office spaces?

Like research space, work and curatorial office areas should be convenient to, but not included in, the storage space for the reasons stated in number 8 above.

11. How do I establish proper physical security for the collection storage space?

Your collection must have appropriate security. You will need to conduct an assessment of the security risks to the stored collection. Refer to Chapter 12 of this handbook for details on conducting a risk assessment and for specific security guidance.

12. How important is fire protection in the storage space?

Collection storage houses the majority of the museum collection and that space must be assured the safeguard of early fire detection and suppression and prior planning to guarantee the safety of the collection and the personnel who use and care for it. Refer to Chapter 11 of this handbook for conducting a fire risk assessment and for specific fire protection guidance.

13. What should the collection storage environment be?

Your storage space should maintain an environment conducive to museum object preservation. A proper collection storage environment is one that:

- controls the range of temperature and relative humidity
- reduces the fluctuations of temperature and relative humidity
- prevents damage resulting from air pollutants
- prevents damage resulting from light

- eliminates biological infestations by insect and rodent pests.

Refer to Chapters 5 and 6 for guidance on monitoring and controlling the collection storage environment and on establishing an Integrated Pest Management (IPM) program to monitor pest activity.

14. What are museum storage equipment and container requirements?

The use of specialized storage equipment and containers will help you preserve and effectively manage your museum collection. The use of proper storage cabinets, shelves, racks, and containers will facilitate maximum use of the space and accessibility to the museum collection and prevent damage from environmental deterioration. Appropriate storage containers buffer the objects from their immediate environment by being chemically stable and neutral, and providing physical protection. For specifics on collection storage equipment and containers refer to Sections G and H and the Bibliography of this chapter. For equipment and supply vendor source and address lists refer to Appendix J of this Handbook. Also refer to the DOI *Tools of the Profession* for a more comprehensive list of materials and equipment suitable for managing museum collections.

15. Does housekeeping have a role in collection storage?

Yes. Because museum objects are stored in a separate dedicated space and not always on view to staff, there is always the possibility of neglect. Good housekeeping in storage spaces is essential to a unit's preventive conservation program.

You should:

- Establish and follow a museum housekeeping plan. Refer to Chapter 7 for guidance on establishing a housekeeping plan.
- Prohibit smoking, eating, and drinking in the storage space.
- Implement and follow an integrated pest management (IPM) program.
- Routinely dust and vacuum the storage area including cabinets and shelving. Vacuum and mop floors to reduce levels of dust and soil.

### **C. Planning Collection Storage Space**

1. Should I plan my museum storage space?

Yes. Planning for museum storage is essential to ensure maximum preservation and optimum access to the collection. Planning a collection storage space will help ensure that the necessary requirements are met. The process of collection storage planning may focus on:

- the development of a new space or facility
- the rehabilitation or upgrading of an existing space or facility
- Consideration and evaluation of storage in non-Federal repositories
- a specific aspect of museum storage such as determining equipment and space requirements for a collection, determining a special layout of equipment, or outlining specific techniques for housing museum objects on shelves or in cabinets.

In the Department of the Interior, the product of collection storage planning may be:

- a Collection Storage Plan (CSP), which can also be considered
- a chapter or section on museum property storage in a Collection Management Plan (CMP), a Collection Condition Survey (CCS), or an archival survey.

2. What is a Collection Storage Plan (CSP)?

The Collection Storage Plan is a stand-alone document developed to help a unit improve the storage conditions for a museum collection. A CSP may be prepared to solve specific storage problems, guide renovation of an existing space into collection storage, guide design of a new facility, or make recommendations regarding storage in a non-Federal repository.

A CSP must include the following core elements:

- a determination of the size of storage space needed

- a determination and listing of specialized storage equipment needed
- a floor plan illustrating a recommended layout of equipment
- assessment of object storage techniques and methods and recommendations for improvement
- a solution for unit-specified or urgent storage problems

A CSP may also include a written assessment of the following:

- collection composition and specific recommendations based on collection type
- existing collection storage facility and/or space(s)
- existing storage conditions in comparison with DOI standards and requirements for storage
- identification and discussion of storage space alternatives.

The specific nature of the collection and the availability of funding and staffing are factors to consider when selecting alternative storage options.

3. Who can write a collection storage planning document?

For objectivity and diversity of views, DOI curatorial staff from outside the unit usually prepares a collection storage planning document. You can also procure the services of a museum professional or architectural/engineering firm with expertise in collection storage planning.

Contact your bureau Interior Museum Property Committee member, regional curatorial staff, or the Interior Museum Program for guidance on writing a storage planning document. The Interior Museum Program can provide examples of a CSP or storage chapter or section of a CMP, CCS or archival survey.

4. How much does a storage planning document cost?

To produce a basic CSP (addressing the core elements listed above) requires funds for:

- approximately 2-4 weeks of the preparer's time
- travel and expenses for a 1-2 week site visit
- printing and duplicating the document

To produce a CSP with more than the core elements will require additional time and increased costs.

The cost to produce a collection storage chapter or section of a CMP, CCS, or archival survey is incorporated into the overall cost of the CMP, CCS, or an archival survey.

5. Where do I get funding to do a collection storage planning document?

Possible funding sources to produce collection storage planning documents are:

- The unit's base funding
- The Bureau's cultural resources program
- Special bureau funding initiatives that may be announced
- The unit's cooperating association (if one exists) donation account

To obtain storage planning project funding you identify and justify the need for a collection storage planning document:

- in the DOI Checklist for Preservation, Protection, and Documentation of Museum Property. Identifying the need in the Checklist links the project to the Department's strategic plan and the Government Performance and Results Act (GPRA.)
- as a project statement in a bureau resource management plan (RMP)

6. Where do I include technical supporting information and drawings such as floor plans in the storage planning document?

Use appendices or attachments for technical information such as product/source information, environmental monitoring data, illustrations for constructing specialized equipment and floor plans. Preparers should consult the bureau's

Interior Museum Property Committee representative and the Interior Museum Program office for assistance in gathering material for appendices.

**D. Assessing Collection Storage Needs**

1. How do I assess the collection?

To assess the collection:

- Examine the entire collection with emphasis on objects designated for storage. Also consider all objects that may eventually be placed in the storage space.
- Note the types of objects, the quantities of each object type, the relative sizes and required volumes for storage. For example, two types of historical wood and metal composite objects are a hammer and a wagon. Both fit into the major category of history, however, each object type has different storage requirements and containment needs.
- Note object types by discipline and material makeup. Note the types of objects that are extremely sensitive to the environmental influences of temperature and relative humidity, light, UV radiation, and air pollution.
- Identify the types and approximate quantities of objects that the unit plans to acquire in the future. Study the unit's approved Scope of Collection Statement (SOC.) See Chapter 3 in this Handbook for information regarding the SOC. In addition, consider the return of outgoing loans and any temporary transfers, and loans, and future archeological and natural science research projects that may increase the size of the collection.

2. How do I assess physical security needs?

Use the following guidance in assessing the physical security needs:

- Conduct a physical security risk assessment as described in Chapter 12.
- Note any extant intrusion alarm system (type, location of sensors, nature of monitoring, who responds, and response time) serving the space.
- Note the construction and locking system of doorframes and the doors (metal, solid-core wooden, wooden hollow core, dead bolt locks).

- Note how windows are secured (latches, covered with plywood, bars).
  - Identify the unit staff who have keys to storage area and unit staff who require access but are not issued keys. Note whether staff members from other divisions need to enter or pass through the area to access utility boxes or controls or cleaning supplies.
  - Note any other functions that occur in the storage space.
  - If applicable, note any areas in the storage space where security is compromised because of easy access from an adjoining space such as through a dropped ceiling.
  - Note if a visitor/researcher log is used and maintained.
3. How do I assess fire protection needs?

Use the following guidance in assessing the fire protection system:

- Conduct a fire protection risk assessment as described in Chapter 11.
  - Note any extant fire protection system. Include type of system (wet pipe sprinkler, water mist, Halon™ or Halon™ substitute, ionization, smoke, heat activated) serving the space.
  - Determine how the detection alarm is monitored, the responsible party for responding to an alarm, and the response time.
  - Check to see if the unit's has a structural fire plan and if it is current. The plan should clearly identify the pre-suppression actions for the responding authorities (for example, how to enter the storage space, priority list for evacuating objects).
  - Identify the number, types, and locations of hand-held fire extinguishers. Check extinguisher inspection tags and labels to ensure proper maintenance.
  - Identify the closest water supply available to suppress a fire.
4. How do I assess environmental monitoring and control needs?

Assessing the collection storage environmental needs involves:

- becoming familiar with the information on environmental monitoring and control found in Chapter 5.
- noting the readings at the time of the site visit for temperature, relative humidity and light levels of the existing space.
- noting the type of the environmental monitoring equipment (hygrothermograph, hygrometer).
- checking to ensure that environmental monitoring equipment is properly calibrated and maintained.
- examining the data recorded on temperature and relative humidity within the storage space. In particular, note the following information:
  - annual maximum and minimum temperature readings and relative humidity levels.
  - monthly maximum and minimum temperature readings and relative humidity levels.
  - maximum diurnal (24 hour) fluctuation for temperature and relative humidity on a monthly and an annual basis.
- answering the following questions:
  - Do the records indicate the maintenance of a proper environment?
  - Are the climate control system (heating, ventilating, air-conditioning [HVAC]) or superior insulation and vapor barrier contributing factors to maintaining the environment?
  - Do the records indicate diurnal changes if HVAC equipment is turned off after working hours?

Note the type of HVAC (air-handling) system in use in the space (oil-fired furnace, heat pump, central air). Note whether the system is dedicated to controlling the environment within the storage space or the entire structure. In particular note the following information:

- location of the thermostat and/or humidistat
- the location of air supply and return registers
- how the air is filtered.

Obtain manufacturers data on equipment (literature, operating manual). Determine maintenance history of equipment.

If applicable, determine if portable dehumidifiers, humidifiers, or air-purifiers have or have had an impact on controlling RH conditions.

Examine the data on visible and UV light levels in the storage space. Check fluorescent lighting to ensure that light filters are installed. Use ultraviolet radiation monitor to take readings to ensure that filters are controlling ultraviolet radiation levels.

If there are windows in the space, note if:

- the staff recorded light levels for both winter and summer months.
- blinds, curtains or light filters have been installed.

Note levels of dust and possible sources of dust. Note the types of dust covers used to protect objects stored on open shelving (for example, plastic, muslin).

- If available, obtain measurements for sulfur dioxide, hydrogen sulfide, and oxides of nitrogen from the Environmental Protection Agency or a local agency. Attempt to identify industry in the area that could produce pollutants that affect the collection. If appropriate, examine data available on pollutant readings from a number of years. Note any trends and describe the existing and potential threats to the collections.
- Note any current evidence and history of biological infestation. Determine if the unit has an Integrated Pest Management program in operation. Note data that staff has recorded on types of pests in the traps.

5. How do I assess museum storage equipment needs?

Use the following guidance in assessing the storage equipment:

- List the types of existing storage equipment (museum storage and specimen cabinets, map cabinets, file cabinets, shelving, painting racks, specialty racks, high density storage systems). See DOI *Tools of the Profession* for equipment types and descriptions.
- Note the manufacturer and model number of each type of equipment. If the equipment is non-standard, note its size (width, depth, and height).
- Note the condition of the equipment (operation of locks, condition of gaskets, evidence of rust, dents, holes, scratches).
- List any equipment you will need to replace.
- Note if additional museum equipment is needed. Are there museum objects that need to be contained?
- Determine if you will need specialized equipment or adaptations to equipment to house specific types of objects or make more effective use of the space. For example, additional space might be provided by installing a high-density storage system or by installing racks to make optimum use of vertical storage space or to store objects on a wall.
- Determine if a rearrangement of the equipment could better use the existing space.
- Note the types and numbers of equipment used to monitor temperature and relative humidity and types of portable equipment used to achieve required environmental levels.
- Note the type of equipment that is used in the housekeeping program for the space (vacuum cleaner, mops, buckets, brooms, dust mops).

6. How do I assess object storage techniques and methods?

Use the following guidance for assessing object storage techniques and methods.

Note:

- the condition and appropriateness of equipment used.
- how types of objects are organized in cabinets, racks and shelves. Indicate if objects are crowded or stacked.
- how individual objects are contained. Indicate whether
  - containers are appropriate and provide adequate physical protection.
  - objects are stable and set securely in their containers.
  - objects are adequately cushioned to prevent them from moving or sliding when being accessed.
- Make recommendations for improving storage techniques.

You may wish to use the assessment worksheet with observation/recommendation codes to simplify the assessment process. Refer to figures at the end of this chapter: Figure 9.5 for a sample worksheet and Figures 9.6 and 9.7 for assessment codes.

## **E. Assessing the Current Collection Storage Space or Facility**

### **1. How do I assess the existing storage space or facility?**

Examine the existing structure(s) and space(s) within each structure that are used for museum property storage to identify how well it meets the storage standards:

- Note the structure's construction and fabric (wood, masonry, two-story, one-story).
- Record the overall dimensions of the space and the ceiling height and type (e.g. 8' dropped ceiling).
- Note the number and size of access doors (measure all doors that objects will pass through).
- Determine with the assistance of an architect or engineer, if the structure

has the strength to safely withstand the loads associated with the collections to be stored. This is especially important for second floors in a structure. Note: Ceramics, metals, paper, glass, and wood objects in volume produce considerable weight.

- Note any characteristics of the structure that would hinder the movement of objects or equipment. Stairs impede the movement of objects, especially large and heavy ones. Such access routes also increase the risk of accidental breakage.
- Note sizes and directional orientation of windows, and types of glazing (glass, Plexiglas™ [acrylic], Lexan™ [polycarbonate]).
- Note any electrical service and plumbing fixtures and determine if existing electric service has capacity for add-on functions such as air-conditioners, humidifiers, dehumidifiers, additional lighting.
- Note wall coverings (dry wall, plaster, brick, paneling). Some wall coverings and construction are more fire-resistant and secure than others.
- Note type and location of light fixtures (incandescent, fluorescent, combination).

2. How do I represent and record information about the storage space and structure?

Prepare a floorplan that indicates the following information:

- dimensions and arrangement of storage areas, including structural features that may restrict arrangements of equipment and must be worked around (structural posts, beams, conduit, drains)
- location of doors, stairs, and windows
- location of electrical service (conduit, outlets, switches, fixtures, and panel boxes) and plumbing (pipes, valves, and drains)
- dimensions and existing location of museum specimen cabinets and shelving, including aisle widths
- location of fire detectors/suppression system detectors and sprinkler heads, and fire extinguishers, stand pipes, and any other fire protection equipment

- location of environmental monitoring and control equipment

Security systems and devices are generally not indicated on the floor plan because dissemination of the plan could jeopardize security.

## **F. Planning a New or Upgraded Storage Space**

Use the information you gathered in your assessment of storage needs (section D) and your assessment of the current storage space (section E) to plan your new or improved storage space.

Only after you determine how much equipment you need and the space you need to house that equipment can you adequately assess storage locations and spaces.

1. How do I determine the storage equipment needed?

Refer to NPS *COG 4/10, "Determining Museum Storage Equipment Needs"* for guidance on determining equipment needs.

2. How do I determine how much space is needed to store my collection?

The amount of storage space you need is derived through a process of matching the materials in your collection to specialized equipment necessary to store the materials. Then determining the amount of space needed to contain the equipment. Refer to NPS *COG 4/11, "Determining Collection Storage Space Requirements"* to determine your space requirements.

3. What process do I use to evaluate potential storage locations?

Consider conducting a value analysis of the collection storage function if you find that your current storage space is inadequate in size to house the collection or if for other reasons the current space is unsuitable. A value analysis is a problem solving process of defining the problem, exploring all alternatives to solving the problem, and deciding on the best solution.

4. What storage space alternatives should be examined?

There are several space alternatives that you should consider. These include:

- Modifying or retrofitting the existing storage space

This alternative may include upgrading the space with new environmental, fire protection and security systems, installing insulation and a vapor barrier or rearranging the storage equipment. Use floorplans and other drawings to represent changes to the space. Also record written details of any changes. Describe how existing conditions can be corrected to conform to DOI requirements.

See “Prototype Artifact Storage Structure – Instructional Package”, a NPS technical publication available from the NPS Midwest Support Office. This publication guides a unit in developing or upgrading storage space in an existing historic structure. The same instructions and information are also applicable for use in a non-historic structure.

Retrofitting may also involve the use of an insulated modular structure (see description in the DOI *Tools of the Profession*) and in section G2.

- New storage locations in the unit

This alternative involves looking at and evaluating other spaces in the building or other buildings in the unit. Provide a description of the actions needed to adapt space(s) to conform to DOI storage requirements. You may use an insulated modular structure to adapt an alternate location into acceptable space. In each instance, gather and record the pertinent information you need to assess the appropriateness of the space. Use floorplans and other drawings to detail use of the space. Refer to section E2 for information to be recorded on the floorplan and example figures at the end of this chapter.

- Development of new space (either in a dedicated facility or combined with other unit functions such as a visitor center or research center)

Use floorplans and other drawings to detail use of the space. Refer to section E2 for information to put on the floorplan.

- Offsite storage in leased space

Use floorplans and other drawings to detail use of the space. Refer to section E2 for information to put on the floorplan.

- Storage in an off-site bureau central repository

Some bureaus (particularly the NPS) operate centralized repositories for storage of archeological collections. This alternative allows for ease of processing, analysis, storage, and research for large collection of materials recovered systematically from within a unit's boundaries. This may be a preferred option when your unit has no:

- acceptable space to house objects safely
- qualified curatorial staff to provide day to day care for the collection

- Storage at a university, college, historical society, non-Federal repository or museum, or other non-DOI institution.

Your IMPC representative or regional curatorial staff can assist in making arrangements with non-DOI repositories for the storage and curation of collections. **Institutions that house DOI museum collections must meet DOI standards and requirements for museum object preservation and protection.**

- Consolidated storage with another bureau unit

You may find it necessary or advantageous to arrange to store your collection with a unit that has available space and staff to care for it.

- Consolidated storage with another departmental unit or other federal agency

You may find it necessary or advantageous to arrange to store your collection with another departmental unit or other federal agency that has available space and staff to care for it.

- No change in the existing storage space

You should list the reasons why your current storage space will continue to be used and list possible consequences to the collection if the space does not meet storage requirements.

5. What other storage factors should you consider?

Consider the following when planning collection storage:

- Phase project to allow improvements to occur as funding becomes available. For example, rehabilitate the space one year; install environmental control equipment and security and fire protection systems in a second year; purchase replacement and new equipment in the third year.
- Prepare appropriate programming documents. Refer to Chapter 14 of this handbook for guidance
- Maintain and store only museum collections that are identified in the unit's approved Scope of Collection Statement.
- Maintain museum collections for easy access by users. As a rule, the unit can make better use of the collection if it is readily accessible on site.

## **G. Housing Museum Objects**

1. Why is it important to use specialized museum storage equipment?

Museum storage equipment offers “front line” protection for museum objects. Specialized museum equipment provides physical containment and isolation from many of the factors that negatively affect object condition. Museum cabinets have synthetic gaskets that create an interior microenvironment that buffers temperature and relative humidity fluctuations, prevents insect and vermin infestations, and prevents damage caused by light, dust, and pollution. Shelving units provide physical protection for objects too large, awkward or heavy to fit within museum cabinets. Specially designed racks accommodate and provide physical protection for hard-to-store objects. Special building systems are available for creating quality space inside other structures.

2. What types of equipment does the DOI use for storing museum collections?

### **Cabinetry**

DOI uses three primary types of cabinets to form a basic modular system that facilitates efficient organization and access to the objects. Refer to COG 4/4, *Modular Concept of Museum Specimen Storage Cabinets*. These three cabinets are the standard museum cabinet, the doublewide museum cabinet, and the

wardrobe cabinet. In addition, there are entomology and herbarium cabinets, map cabinets, large flat storage cabinets, and utility cabinets. Refer to the DOI *Tools of the Profession* for descriptions and sources of available museum cabinetry.

### **Shelving**

Several types of shelving are available. Refer to the DOI *Tools of the Profession* for descriptions, uses, and sources of available museum shelving. Steel shelving units, pallet racks and slotted angle racks are frequently used. Steel shelving and wire rack shelving are recommended for boxed archival and manuscript collections. Pallet racks and slotted angle racks are particularly useful for storing furnishings and other larger, heavier items. Slotted angle racks are constructed using lengths of metal angle that can be custom cut. You can configure and construct a slotted angle rack for objects with specific support or space requirements. You can use metal panels or plywood coated with a water based two-component epoxy or water based aliphatic urethane paint for shelf decking.

### **Prefabricated Modular Structures**

A prefabricated building system can be used to create a collection storage facility that is economical to construct, efficient to operate, and effective in creating appropriate environmental conditions. The building system is made of superinsulated, foam-core, metal-sheathed panels. It should be used only inside a host structure. Refer to NPS Preservation Tech Note, *Museum Collection Storage in an Historic Building Using a Prefabricated Structure*; CRM Supplement, *Collection Storage – Making a Case for Microenvironments*; COG 4/7, *Museum Collection Storage Space: Is an Insulated Modular Structure Right for your Collection?*; and COG 4/8, *Selecting Environmental Control Systems for Insulated Modular Structures*, listed in the Bibliography of this chapter. These publications provide discussions and give guidance in using this special building system for museum storage. The DOI *Tools of the Profession* provides information on sources for this building system.

3. What are some general considerations when using museum equipment?

Consider the following when using museum storage equipment:

- In planning for cabinets and shelving, examine all objects in the collection. To the extent possible, organize objects by material type and size rather than by provenience or accession/catalog information.
- Ideally, do not install cabinets and shelving units against exterior walls. This situation may lead to condensation inside the cabinets.

- Ensure that museum cabinets are free of rust, have intact gaskets to provide good sealing action, have smooth operating doors, and have working keyed or combination lock mechanisms. Early museum specimen cabinets used polyurethane foam gaskets that deteriorate over time or felt gaskets that may contain toxic insecticides. You should replace these gaskets. See *COG 4/3, Installing the Retrofit Gasket Kit*.
- Keep loads in museum cabinet below 50 pounds per drawer. Don't stack museum cabinets more than two high. Raise museum cabinets and shelving units off the floor at least four inches (preferably six inches). Raising cabinets off the floor reduces the chances of damage to objects in case of flooding. It also facilitates the cleaning of floors and inspection for pests.
- Use closed cell polyethylene foam in museum cabinet drawers and on shelving to cushion objects. To prevent museum objects from sliding or shifting when drawers are opened and stabilize objects in specimen trays, by padding with foam or by cavity packing. Refer to the *DOI Tools of the Profession* for sources of foam and museum specimen trays.
- Assign and affix a unique number to all shelving units, individual shelves, cabinets, and individual cabinet drawers. This will help you locate museum objects.

## H. Using Containers and Mounts

1. Why is it important to use storage containers and mounts?
  - Museum storage containers provide a buffer between the object and its immediate environment. Mounts provide physical reinforcement for fragile objects. Archival quality containers and supports not only increase the level of protection and preservation, but also contribute to the organization of the collection.
2. What kinds of containers and mounts should I use for storing museum objects?

A variety of containers and mounts are recommended for storing museum objects. Descriptions of the more commonly used containers and mounts follow. See the *Museum Property Handbook, Volume 1, Appendices G and J*, and the *DOI Tools of the Profession* for additional information.

- Boxes

Archival boxes come in a variety of types, shapes, and sizes. Most archival boxes are made of acid-free, buffered paper board or inert, corrugated polypropylene or polyethylene plastic board. The corrugated plastic boxes are often used to store archeological and archival materials. (Corrugated plastic boxes are generally stronger and the plastic board material sheds water, thereby, offering more protection against water damage.)

Archival boxes can be used to store archive documents, objects, rare books, prints, photographs, and textiles.

- Specimen Trays

Specimen trays are made of buffered, acid-free board. They can be used to hold objects and selective natural history specimens. Pigments and proteins in some natural history specimens may be damaged by the alkaline buffering in specimen trays. Consult with your IMPC representative or a conservator before using specimen trays to store bird and mammal specimens.

The trays are designed in a system of modular sizes to fit into DOI museum cabinets in a myriad of different arrangements. Use of specimen trays enhances organization of your collection.

- Folders

Archival folders are made of buffered, acid-free folder stock paper. Folders in letter and legal folder size formats are used to house archival documents. Accordion folders in letter and legal size are used to store manuscripts. Map folders of a variety of sizes are used for oversized paper items.

- Photo Enclosures

Enclosures for housing photographic prints and negatives are made in a sleeve style (closed on three sides) and a 4-fold style with overlapping flaps. The acid-free paper used for enclosures may be either buffered or unbuffered.

- Plastic Bags

Polyethylene interlocking seal “zipper” bags may be used to house archeological materials and other small objects for storage in archival boxes and museum cabinets. They are also used for cold storage of photographic materials as they will prevent moisture from condensing on an object as it acclimatizes to room temperature. These bags may also be used to isolate objects from pests by either containing infested objects or acting as a barrier to

prevent pests from attacking an object. (Avoid the use of bags developed for food storage that have printing inks or dyes.)

- **Plastic Liners**  
Polyethylene foams are inert, closed-cell, and moisture resistant. Some brand names include Ethafoam™, Volara™ and Plastazote™. ¼”-thick sheets of foam may be used to line metal cabinet drawers or cover wooden or metal shelves. The liners provide objects with a non-reactive cushion on which to set.
- **Cavity Packing**  
Polyethylene foams can be used to cavity pack certain objects. Cavity packing creates secure compartments in which to place objects. Compartments the size and shape of objects are cut in the foam. The compartments surround the object restricting movement and giving support.
- **Mounts**  
Polyethylene foams are also used to create mounts to structurally support objects in order to alleviate stress on weak points of the object. The foam is usually cut to the shape of the object and forms a secure base on which the object can rest.

## **I. Special Storage Techniques**

1. Where do I find information on techniques for storing different types of museum objects?
  - Conduct an Internet search for information or references on museum storage of specific materials.
  - The COG series address the curatorial care of different types of objects, specimens and archival collections and recommends materials to use. Selected bibliographies included in each COG provide additional references for the care and storage of each type of material.
  - The DOI *Tools of the Profession* recommends supplies, equipments, materials, and techniques for the range of objects you have as museum property. Figures 9.7, 9.8, 9.9, 9.10, 9.11, and 9.12 illustrate some of the equipment and techniques for storing museum objects.

**J. Storage of Museum Objects Subject to *The Native American Graves Protection and Repatriation Act of 1990* (NAGPRA)**

1. What is NAGPRA?

The Native American Graves Protection and Repatriation Act of 1990 (25 USC 3001, et seq.) addresses the rights of lineal descendants, culturally affiliated Indian Tribes (including Native Alaskan villages or corporations), or Native Hawaiian organizations to certain Native American human remains, funerary objects, sacred objects, and objects of cultural patrimony with which they are affiliated. The law requires federal agencies, and museums that receive federal funds to:

- Conduct inventories and summaries of such items in their collections
- Repatriate (return) items identified pursuant to NAGPRA to the appropriate lineal descendants, culturally affiliated Indian tribes, or Native Hawaiian organizations, if requested.

For additional information on NAGPRA you can access the official website at <http://www.cr.nps.gov/nagpra/>.

2. What types of items subject to NAGPRA might be found in DOI museum property collections?

- Your unit's museum property collection may include items subject to NAGPRA such as human remains, pottery, beads, prayer bundles, clothing, weapons, pipes, or other funerary, sacred, and cultural items that are determined to belong to one or more lineal descendants, Indian Tribes, Native Alaskan villages or corporations, or Native Hawaiian organizations. The recognized culturally affiliated organization or lineal descendant may request the repatriation of these items.

The individual, tribe, or organization requesting repatriation may be unable to take immediate possession of the materials, or they may prefer that certain items continue to be housed at your unit. Under these circumstances, the individual, tribe, or recognized organization may want to be involved in determining how the items are preserved and stored. Unit management and staff will need to consult with Bureau or Department NAGPRA coordinators should such a request be made.

3. Are there any special storage requirements for items subject to NAGPRA?

- You should treat museum property items subject to NAGPRA with great sensitivity because of their cultural significance, sacred importance, and the fact that many of these materials were collected without the consent of descendants, tribal leaders, elders, or traditional religious leaders.

Because of their special status, you may need to separate NAGPRA items from other collections. Consult with lineal descendants, Indian Tribes, Native Alaskan villages or corporations, or Native Hawaiian organizations concerning access, storage, and use. Guidance on consultation can be found in Section 10.5 of Final Rule 43 CFR 10 (October 1, 2003) at website address [http://www.cr.nps.gov/nagpra/MANDATES/43CFR10\\_10-1-03.htm](http://www.cr.nps.gov/nagpra/MANDATES/43CFR10_10-1-03.htm).

Accommodate the requirements of the lineal descendant or recognized organization where possible, and institute any needed revisions to your access procedures, planning documents, and operating procedures.

3. How should I store objects subject to NAGPRA?

- Protect NAGPRA subject items from fire, theft, pests, and environmental and other threats as you would any museum object. However, you may need to use additional and/or alternative handling and storage methods and materials to show sensitivity and proper respect for these items in accordance with the affiliated individual's or group's request.

Consult with the lineal descendants or recognized culturally affiliated organization. Ascertain their preferences related to the proper handling and storage techniques and materials, and defer to their wishes where possible. You may be asked to use some of the following storage methods, procedures, and materials when caring for NAGPRA items:

- Store human remains aligned in a particular direction (such as the cranium toward the east).
- Construct special storage containers (possibly using wood, plant, or animal products native to the tribe's homeland).

- Ensure that only organic materials touch the objects. Possible methods to avoid direct contact with archival foams include wrapping the object or covering the foam's surface with archival tissue paper or unbleached cotton muslin.
  - Store newly collected natural plant materials (such as bundles of tobacco) with the objects. You can construct special containers to hold the materials and separate them from other collection items. This will help prevent possible pest infestations.
  - Allow tribal members access to storage areas for relevant religious or ceremonial purposes. This may include actions to protect staff working with or viewing the objects and protect the facility, collections, and items from a negative force.
4. Where do I go for guidance or assistance?
- Contact your bureau IMPC representative or your bureau or Department NAGPRA coordinator for guidance on NAGPRA related collection storage issues.

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**I. List of Figures**

- Figure 9.1 Levels in the DOI Museum Property Collection Storage System
- Figure 9.2 Floor Plan of Proposed Museum Collection Storage: Drawn with AutoCAD® Computer Assisted Design Program.
- Figure 9.3 Floor Plan of Museum Collection Storage Room at Voyageurs National Park. Floor plan shows existing museum equipment and oversized objects.
- Figure 9.4 Example Assessment Worksheet for Storage Techniques
- Figure 9.5 Assessment Codes for Collection Storage Techniques (Page 1 of 2)
- Figure 9.6 Assessment Codes for Collection Storage Techniques (Page 2 of 2)
- Figure 9.7 Cavity storage technique used to house small objects in a standard museum cabinet drawer.
- Figure 9.8 Wardrobe museum cabinet storage assemblies that are designed to house rolled textile objects.
- Figure 9.9 Larger objects housed on steel shelving. Note that the metal surfaces are lined with polyethylene foam. Both plastic and muslin dust covers can be used to protect objects from dust.
- Figure 9.10 A five-drawer map cabinet with a map enclosed in an acid-free document folder.
- Figure 9.11 Slotted metal angle components can be used to construct racks for furniture and other large objects. This versatile material also can be used to fabricate custom designed storage equipment such as the rolling unit for the hallstand illustrated in this figure.
- Figure 9.12 Painting/framed objects rack constructed of slotted metal angle components and 2" mesh welded wire fencing.

**Space (Facility or Storage Room)**

- structure
- spaces within the structure
- systems or infrastructure:
  - mechanical,
  - electrical
  - utility

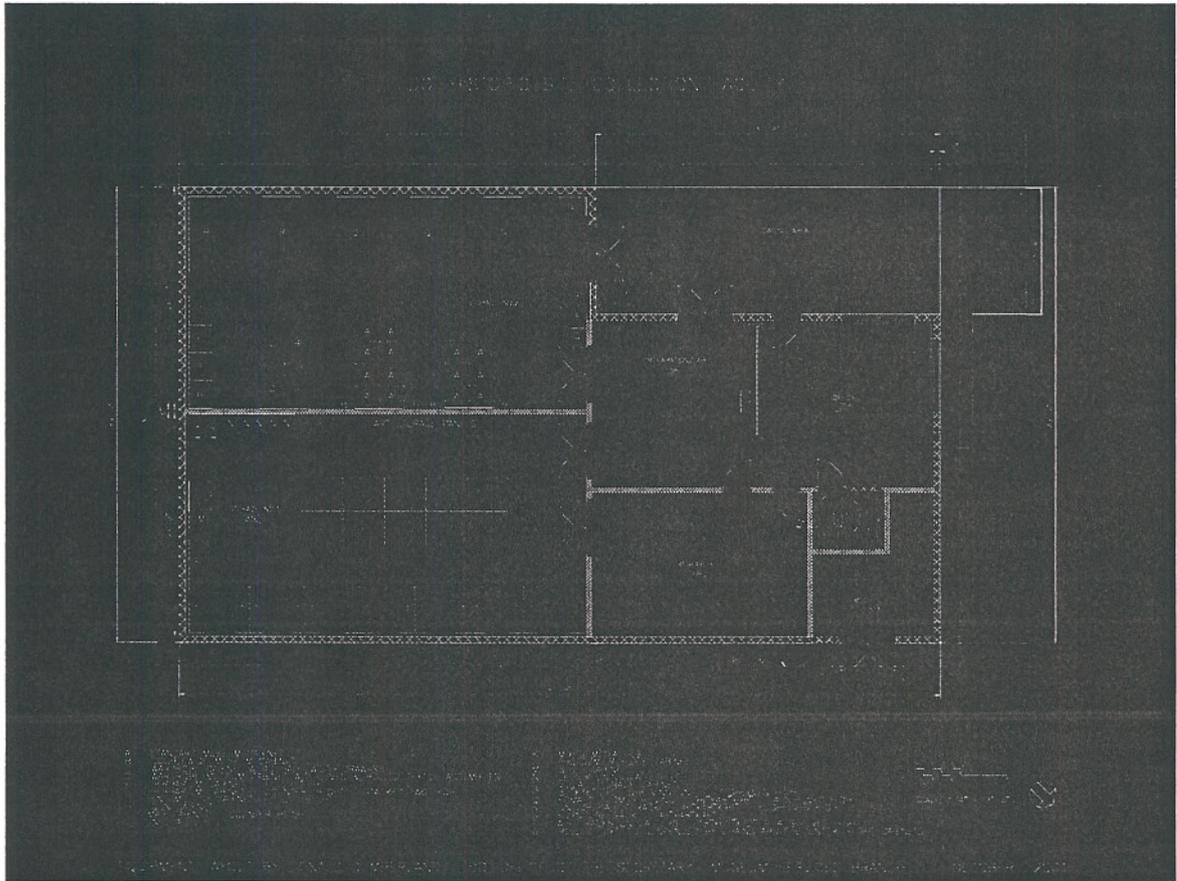
**Equipment (Museum Furniture)**

- cabinets
- shelving
- specialized furniture and racks

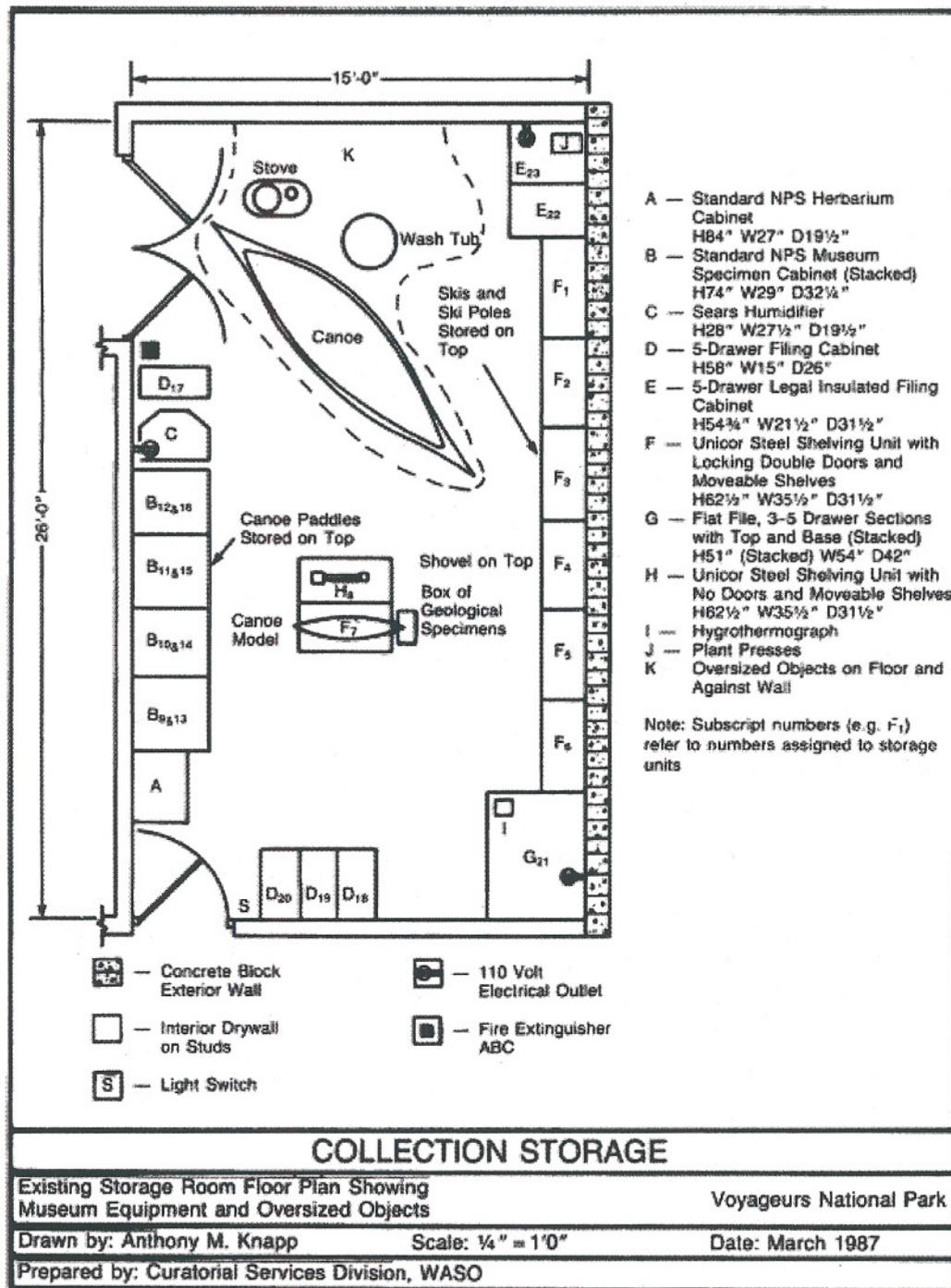
**Containers**

- folders, sleeves, envelopes
- specimen trays
- boxes
- mounts, supports

**Figure 9.1 Levels in a DOI Museum Property Collection Storage System**



**Figure 9.2. Floor Plan of Proposed Museum Collection Facility. Drawn with AutoCAD® Computer Assisted Design Program.**



**Figure 9.3** Floor Plan of Museum Collection Storage Room at Voyageurs National Park. Floor plan shows existing museum equipment and oversized objects.

**FINDINGS AND RECOMMENDATIONS  
FOR UPGRADING STORAGE TECHNIQUES FOR EXISTING STORAGE UNITS**

<u>Storage Unit/Type</u>	<u>Drawer/Shelf</u>	<u>Corrections</u>
--------------------------	---------------------	--------------------

<u>Cabinet 1</u> .....*		
Standard Cabinet		
	1 .....	M,O
	2.....	X
	3.....	M,X
	4.....	*
	5.....	N
	6.....	K
	7.....	U

<u>Cabinet 2</u> .....*		
Standard Cabinet		
	1 .....	*
	2.....	M,O,X
	3.....	X
	4.....	M
	5.....	X
	6.....	*
	7 .....	*

<u>Cabinet 3</u> .....A		
Standard Cabinet		
	1 .....	*
	2 .....	J
	3.....	K,S
	4.....	K,S

**Figure 9.4 Example Assessment Worksheet for Storage Techniques**

## Assessment Code

### Cabinet/Shelving Unit Specific (indicate cabinet or shelving type.)

- A Gasket is damaged, wrong type, or ineffective. Install retrofit gasket or use gasket kit. See *COG 4/3*.
- B Cabinet has no lock. Install sash lock or other locking device.
- C Cabinet or unit is damaged. Repair or replace as required.
- D Cabinet or unit is dusty or dirty. Vacuum or wipe interior and exterior of cabinet or unit.
- E Cabinet or unit paint surface is chipped, scratched or rusty. Repaint with water-based urethane or epoxy paint.
- F Cabinet is directly on floor or shelving unit bottom shelf is not adequately raised off the floor. Raise cabinets on platforms, appliance rollers, or caster bases so that they are 2"-6" off the floor. Adjust shelving unit bottom shelf to be at least four to six inches off the floor.
- G Wooden rack or shelving unit components are unsealed. Seal with water-based urethane or epoxy paint.
- H Drawer slips through glides. Install water-based urethane or epoxy painted metal shims on vertical surfaces of drawer glides to center drawers.
- I Shelving unit in earthquake zone lacks shelf retainers. Install shelf retainers to prevent objects from shaking off shelves.
- J Objects in open or on shelving units are coated with dust. Install dust covers (See *COG 4/2*).

### Drawer/Shelf Specific

- K Objects are loose and unprotected in drawers or on shelves. Place objects in specimen trays and/or cavity pack.
- L Objects too large for specimen trays rest directly on drawers or shelves. Place polyethylene foam pads under objects to form an inert cushioned surface on which the objects can rest.
- M Objects in cabinets or on shelving are unstable and are in danger of damage by sliding or rolling. Pad, cavity pack, or cushion objects with appropriate tissue or foam.
- N Objects are stacked and/or overcrowded. Rearrange or move objects to allow adequate separation.
- O Weight of objects exceeds 50 pound drawer limitation. Remove objects as needed.
- P Objects stored in inappropriate cabinet or rack. Place objects in appropriate cabinet, rack, or shelving unit as indicated.

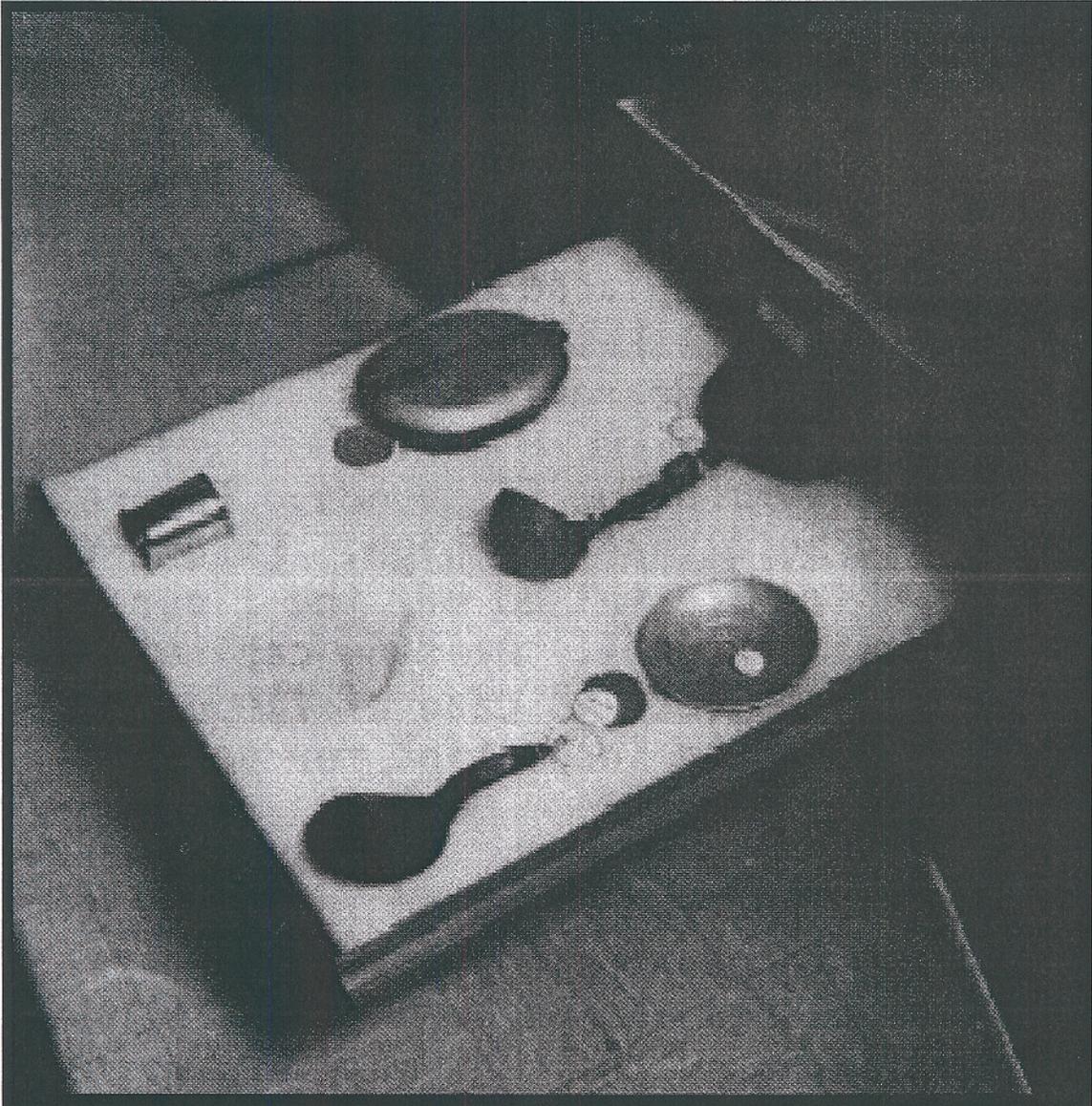
## Figure 9.5 Assessment Codes for Collection Storage Techniques (Page 1 of 2)

## Assessment Code (Continued)

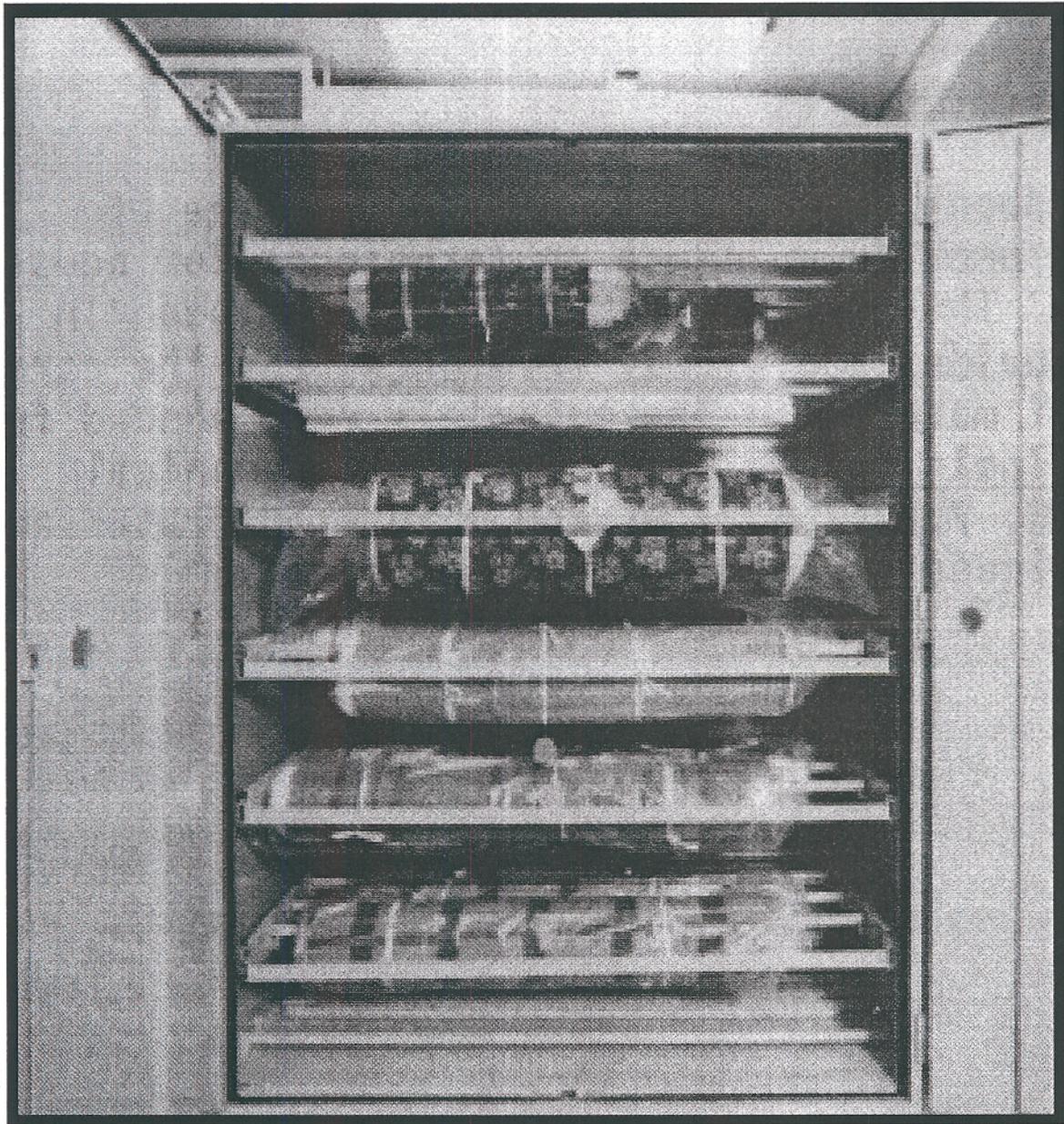
### Object Specific

- Q Documents or books are loose and unprotected. Place documents in archival folders or envelopes and then in document boxes. Place books in rare book boxes (see *COG 19/2*). Place document or rare book boxes in cabinet or on shelving.
- R Photo positives and negatives are loose and unprotected. Place photos in appropriate archival photo enclosures and in photo enclosure boxes. Boxes can be placed in cabinets or on shelving. See *COG 4/9* and *Tools of the Profession* for appropriate usage of enclosures.
- S Maps and oversized prints are stored loose and unprotected. Place objects in appropriately sized archival map folders (blueprints and cyanotypes go only in unbuffered folders) and store flat in appropriate cabinet. See *COG 19/9*.
- T Framed artwork is stored horizontally or stacked leaning against each other. Place artwork on a rack that will separate pieces and store them vertically. See *COG 12/1*. Use dust covers.
- U Unframed artwork and large documents are stored loose and unprotected. Interleave items with archival bond paper and place in print boxes. Boxes can be stored either in cabinets or on shelving.
- V Artwork framed with acidic matboard. Consult with conservator regarding rematting with archival matboard.
- W Organic and inorganic materials are stored in close proximity. Separate dissimilar materials (e.g., metals from proteinaceous organics, such as leather, fur, silk) and store materials with similar requirements together (ideally in cabinets devoted to each material type).
- X Objects stored in containers or labeled with tags made of acidic materials. Replace acidic containers or tags with ones made of archival materials.
- Y Objects have active deterioration, mold or physical damage. Conservation survey should be requested.
- Z Evidence of pest infestation observed. Integrated Pest Management program needs to be implemented or improved.
- XX Other as indicated
- \* Proper storage/acceptable condition

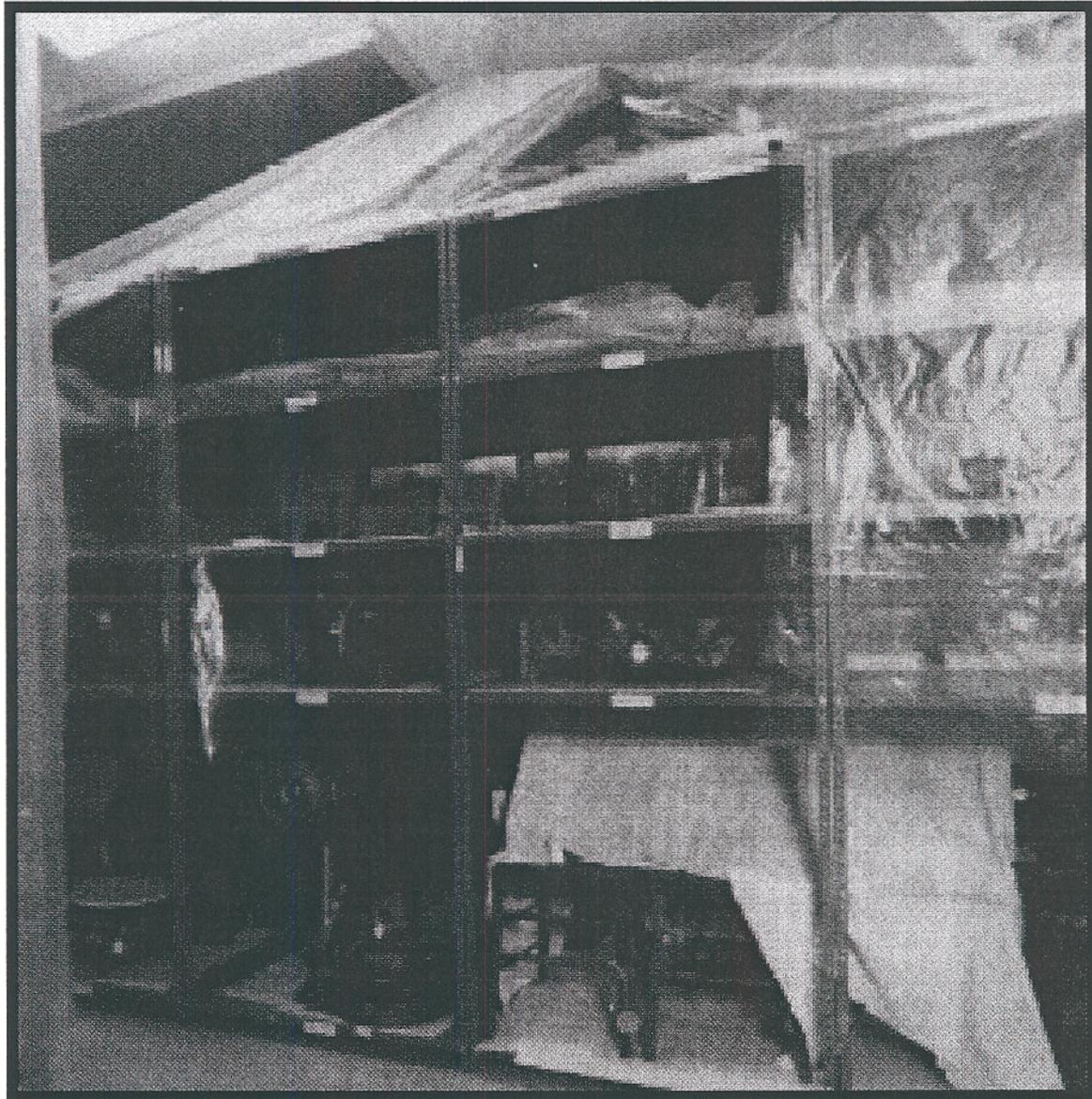
**Figure 9.6 Assessment Codes for Collection Storage Techniques (Page 2 of 2)**



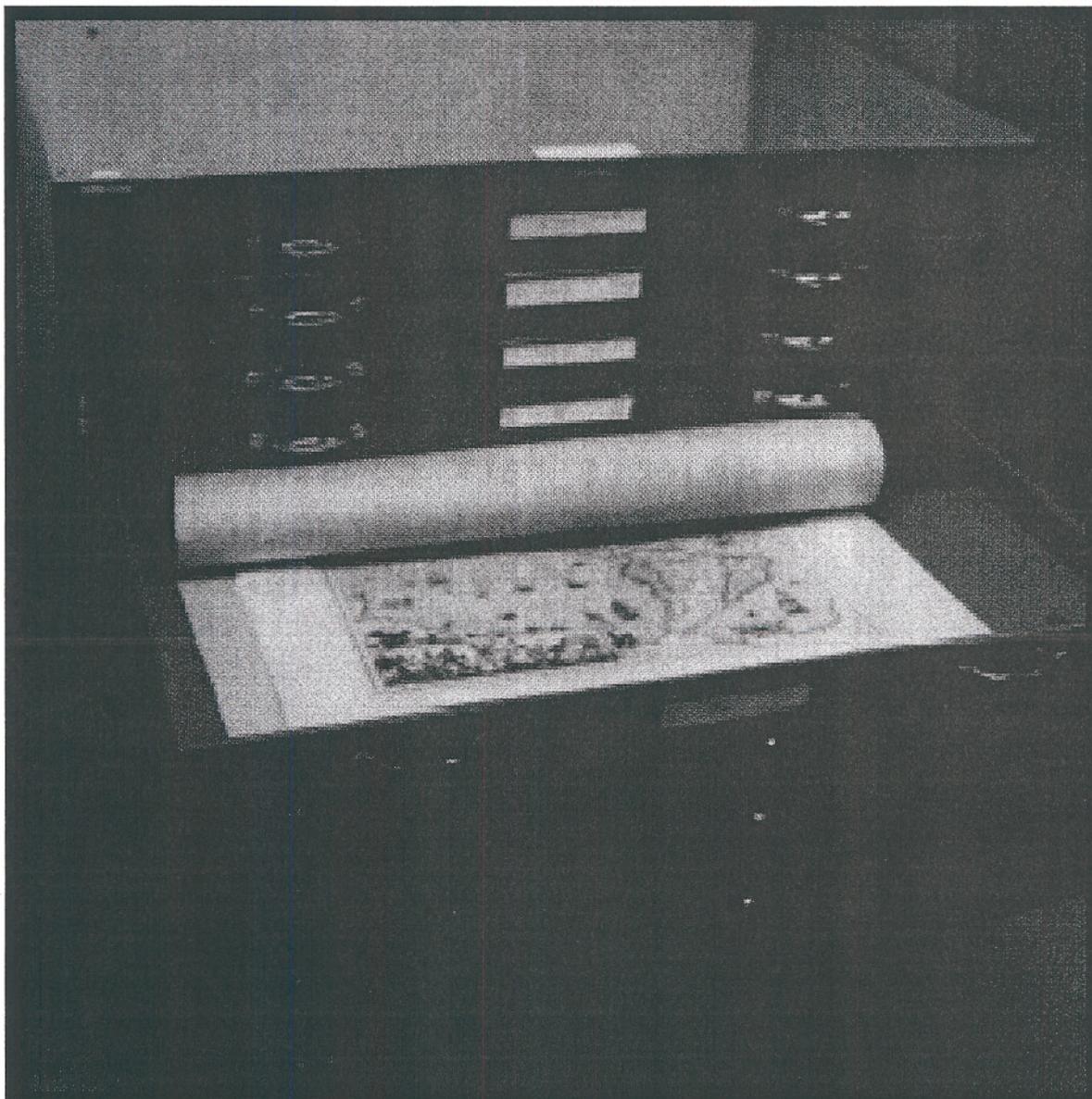
**Figure 9.7** Cavity storage technique used to house small objects in a standard museum cabinet drawer.



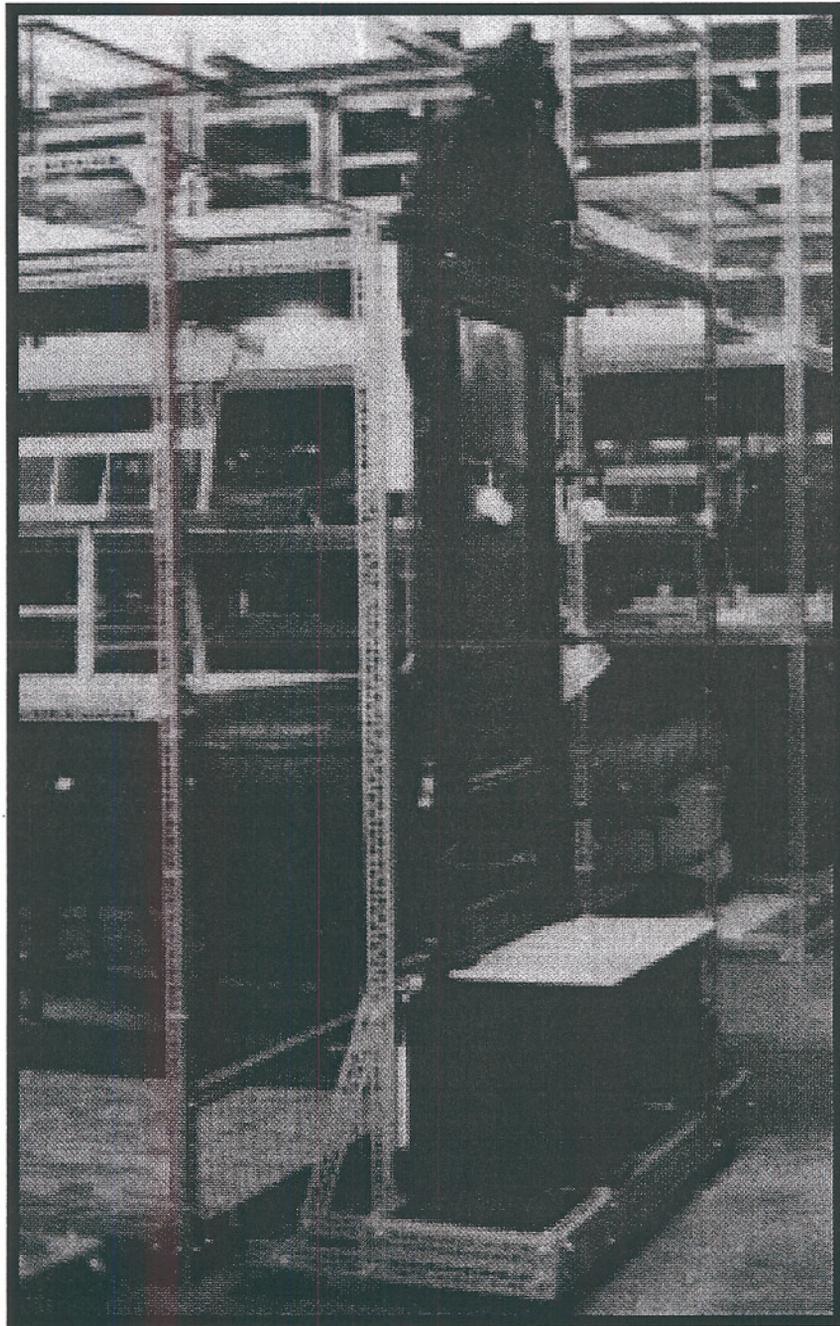
**Figure 9.8** Wardrobe museum cabinet storage assemblies that are designed to house rolled textile objects.



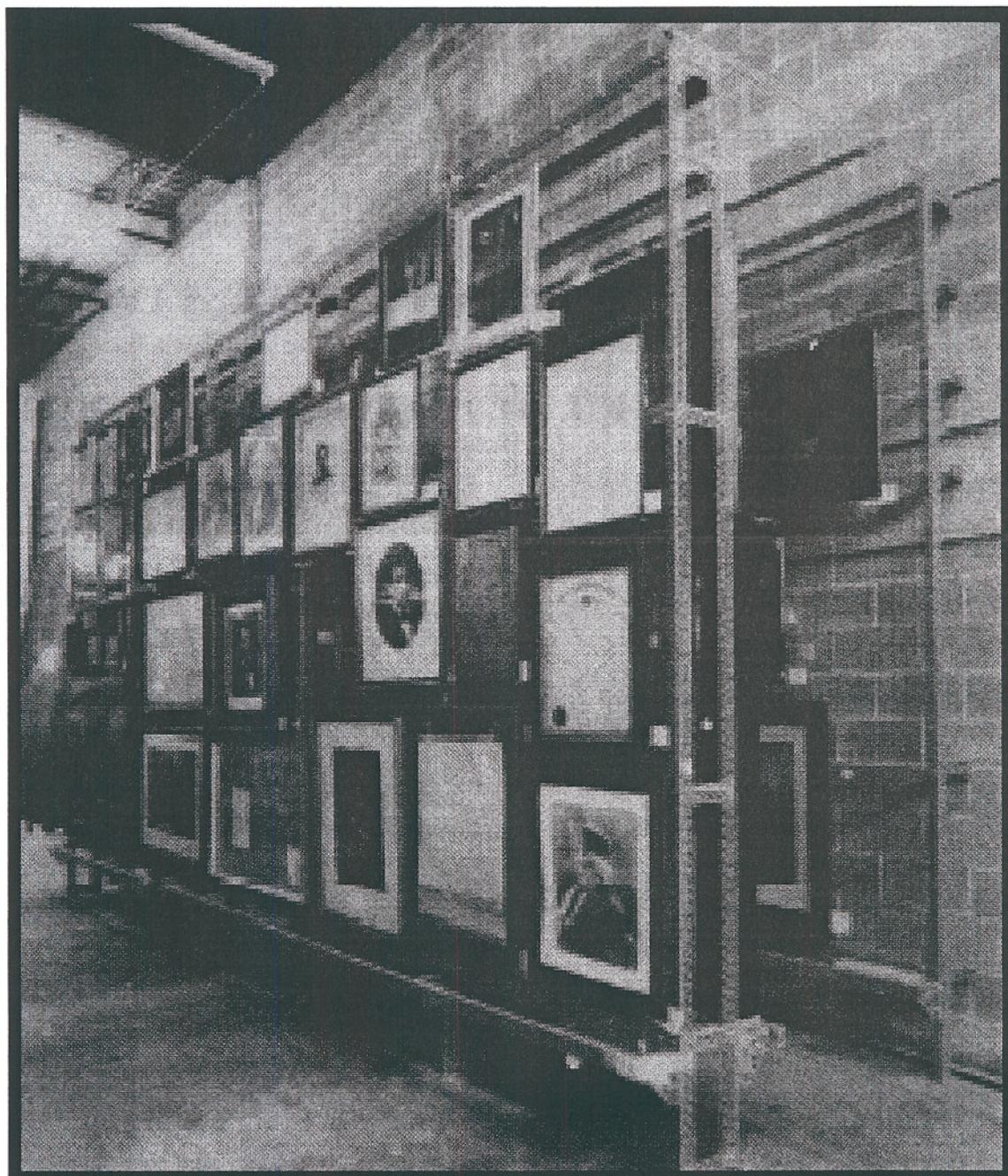
**Figure 9.9** Larger objects housed on steel shelving. Note that the metal surfaces are lined with polyethylene foam. Both plastic and muslin dust covers can be used to protect objects from dust.



**Figure 9.10** Five-drawer map cabinet with a map enclosed in an acid-free document folder.



**Figure 9.11** Slotted metal angle components can be used to construct racks for furniture and other large objects. This versatile material also can be used to fabricate custom designed storage equipment such as the rolling unit for the hallstand illustrated in this figure.



**Figure 9.12** Painting/framed objects rack constructed of slotted metal angle components and 2" mesh welded wire fencing.